MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2022/2023

BEM1034 – MATHEMATICS FOR ECONOMICS

(All sections / Groups)

6 OCTOBER 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **FIVE (5)** printed pages with 4 questions only, excluding the cover page.

2. Attempt **ALL FOUR (4)** questions.

3. Write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

4. Mathematical formula is attached at the end of this question paper.

Question 1 (25 marks)

(a) Let $P=\{a,e,i,o,u\}$, $Q=\{a,b,c,d\}$ and $R=\{e,f,g,h\}$. Show that $P\cap(Q\cup R)=(P\cap Q)\cup(P\cap R)$. Next, compute $Q-P$.

[7 marks]

(b) Solve the following equation.

(i) $\ln(x+4)^2=3$

[4 marks]

(ii) $\log_3 7+\log_3 x=\log_3(x+12)$

[3 marks]

(c) The daily sales at ABC apparel store begin to fall after the end of a promotional campaign. The sales in Ringgit Malaysia (RM) as a function of the number of days after the campaign's end is given by $S=28000\left(\frac{7}{6}\right)^{-0.2d}$. When should ABC apparel store start a new campaign to avoid the sales to drop below RM23,000 per day? Interpret your results.

[7 marks]

(d) Given that a quantity $Q(t)$ is described by the exponential growth model:

$$Q(t)=246e^{0.32t}$$

where t is measured in minutes.

(i) Compute the growth constant.

[1 mark]

(ii) Compute the initial quantity.

[1 mark]

Continued...

(iii) Compute $Q(7)$.

[2 marks]

Question 2 (25 marks)

(a) Let $A=\begin{bmatrix} 0 & 2 & 4 \\ -1 & 3 & 2 \\ 4 & -2 & 3 \end{bmatrix}$, $B=\begin{bmatrix} 1 & 1 & 0 \\ 2 & 5 & 7 \\ 8 & -4 & -1 \end{bmatrix}$ and $C=\begin{bmatrix} 3 & -2 & 1 \\ 2 & 9 & 6 \\ 1 & -5 & -3 \end{bmatrix}$. Show that $(A+B)+C=A+(B+C)$.

[8 marks]

(b) An economy consists of three industries x, y and z. The technology matrix, A and the final demand, D for the economy are given by

$$A=\begin{bmatrix} 0.2 & 0.5 & 0.4 \\ 0.1 & 0.4 & 0.3 \\ 0.2 & 0.2 & 0.2 \end{bmatrix}, \qquad D=\begin{bmatrix} 140 \\ 360 \\ 290 \end{bmatrix}.$$

(i) Compute $I-A$.

[2 marks]

(ii) Compute $|I-A|$.

[3 marks]

(iii) Use Cramer's rule to find the total demand X for industries x, y and z.

Apply formula $(I-A)X=D$ and leave your answer in two decimal points.

[12 marks]

Continued...

Question 3 (25 marks)

(a) Compute the limit for the following function.

$$\lim_{x\to 6}\frac{4x^2-2x+3}{x-3}$$

[2 marks]

(b) Show that the following function is continuous at $x=3$.

$$f(x)=\frac{x+8}{x^2-3}$$

[6 marks]

(c) The quantity of writing tablets demanded each month, q (in units of hundred), related to the unit price in Ringgit Malaysia (RM) is given by the following demand equation:

$$q=\frac{3}{4}\left(15+p^2\right)^{\frac{1}{2}}.$$

If $p=5$, is the demand elastic or inelastic? Show your calculations.

[10 marks]

(d) Use the implicit differentiation to find $\frac{dy}{dx}$ for $5x^2+3x^2y^4=2y+x+8$.

[7 marks]

Question 4 (25 marks)

(a) Solve the following integral:

$$\int 10x\left(x^2+3\right)^4\,dx.$$

[6 marks]

(b) The demand equation for a certain product is given by:

$$p=120-x^2$$

where p is the unit price in Ringgit Malaysia (RM) and x is the quantity demanded each day. Compute consumers' surplus given that the market price is RM8 per unit.

[7 marks]

Continued...

(c) Classify the order of the following differential equations.

(i) $\frac{dy}{dx} + 4x = 5$

[2 marks]

(ii) $\left(\frac{d^3y}{dx^3}\right)^4 = \left(\frac{d^4y}{dx^4}\right)^5 - y$

[2 marks]

(d) Solve the following differential equation using the method separation of variables.

$$x^2\left(2y^4 + 5\right)\frac{dy}{dx} = y^3\left(x^2 - 3\right).$$

[8 marks]

End of Question.

Subject Code: BEM1034
Subject Name: Mathematics for Economics

Summary of Formulas

1. **Input-Output Model**

$$(I-A)\,X=D$$

where A is the input-output matrix, D is the external or final demand and X is the production level.

2. **Total differential (change)**

If $z=f(x,y)$, then the total change is $dz=f_x dx+f_y dy$

3. **Elasticity of demand**

$$\varepsilon_d=-\frac{dq}{dp}\times\frac{p}{q}$$

4. **Consumers' Surplus (CS)**

$$CS=\int_0^{\bar{x}} D(x)\,dx-\overline{\overline{px}}$$

where $\bar{p}$ is the market price, $\bar{x}$ is the quantity sold and $D(x)$ is the demand function.

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